

REMARKS

Claims 83, 86, 88-99, 104, 105, 107, 110 and 111 are pending in this application. Claims 83, 86, 97, 107, 110, and 111 have been changed and claims 82, 102, 103, 106, and 112 have been cancelled by this Amendment. Applicant reserves the right to introduce claims of similar scope to the cancelled claims in a continuation or other related application.

The Examiner objected to claims 102, 103, 106, and 111 because of informalities. Claims 102, 103, and 106 have been cancelled without prejudice. Claim 111 has been amended as suggested by the Examiner and/or as set forth above, so that Applicant respectfully requests that the objection be withdrawn.

The Examiner rejected claim 111 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner stated that the "two axes of rotation" of claim 111 lacks antecedent basis. However, claim 106 recites "axes of rotation" at line 7 (now recited in claim 110). Applicant has removed the word "two" to clarify the antecedent basis, and respectfully requests that the rejection of claim 111 under Section 112, second paragraph, be withdrawn.

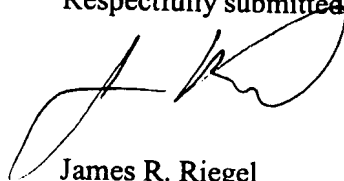
The Examiner rejected claims 102 and 103 under 35 U.S.C. 112, first paragraph, as containing subject matter not described in the specification as to reasonably convey possession of the invention. Since the application is under final rejection, Applicant has cancelled claims 102 and 103 herein, without prejudice, to expedite the prosecution of the remaining claims, and Applicant respectfully requests that the 112 first paragraph rejection be withdrawn. It is noted that Applicant does not agree with the 112, first paragraph rejection and believes claims 102 and 103 are supported. For example, claims 99/102 do not recite that the flex provided between members must be provided in separate members from the other members-- this flex can be part of or inherent in any of the coupled members, as in an embodiment of Fig. 15. Furthermore, Applicant's selection for the first (212b), second (210b) and third (212a) members of Fig. 15 fulfills the limitation of "unitary member" since members 212a and 212b can be connected to member 216 to create a single unitary member. Claims 99/102 do not recite that the unitary member must only consist of the first, second, and third members.

The Examiner rejected claims 82, 97, 106, 107, and 112 under 35 U.S.C. 102(b) as being anticipated by Stern. Applicant does not agree that all the elements of the rejected claims are taught in the Stern reference; however, since this application is under final rejection, to expedite

prosecution Applicant has amended the claims to recite subject matter indicated to be allowable by the Examiner. Therefore, claim 82 has been cancelled and claim 86, which the Examiner indicated was allowable, has been rewritten in independent form. Claim 97 has been amended in accordance with claim 86. Claim 106 has been cancelled and claim 110, which the Examiner indicated was allowable, has been rewritten in independent form. Claim 107 has been amended in accordance with claim 110. Claim 112 has been cancelled. In view of the foregoing, Applicant respectfully requests that the rejection under 102(b) be withdrawn.

Applicant believes that all pending claims are allowable and respectfully requests a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'James R. Riegel', is written over the typed name.

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MARKED-UP VERSION OF AMENDMENTS

In the Claims:

Claims which have been changed by this amendment are indicated as "amended."

Please cancel claim 82 without prejudice.

83. (amended) An interface apparatus as recited in claim [82] 86 further comprising an electronically-controllable actuator coupled to said linkage and able to apply a force along at least one of said at least two degrees of freedom to said user manipulatable object through said unitary member.

86. (amended) An interface apparatus [as recited in claim 82] for interfacing motion of a user with a computer system, said interface apparatus comprising:

a user manipulatable object physically contacted by said user and moveable by said user in at least two rotary degrees of freedom;

a linkage coupled to said user manipulatable object and providing said at least two rotary degrees of freedom to said user manipulatable object, each rotary degree of freedom being about an axis of rotation, said linkage including a plurality of members, wherein a selected number of said plurality of members have been formed as a unitary member in which flex is provided between said selected number of members, said flex permitting motion between said selected number of members that allows motion of said user manipulatable object in at least one of said rotary degrees of freedom, wherein said plurality of members of said linkage are formed as a closed-loop linkage in which said members are flexibly coupled to each other as segments of said unitary member; and

at least one sensor able to detect a position or motion of said user manipulatable object along said at least two degrees of freedom and outputting sensor signals, wherein said sensor signals, or a representation thereof, are received by said computer system.

88. An interface apparatus as recited in claim 86 wherein said closed loop linkage includes:

a ground member coupled to a ground surface;

first and second extension members, each extension member being coupled to said ground member; and

first and second central members, said first central member having an end coupled to said first extension member and said second central member having an end coupled to said second extension member, wherein said central members are coupled to each other at ends not coupled to said extension members and wherein at least one of said central members is coupled to said user manipulatable object, said central members coupled to each other approximately at said coupling of said user manipulatable object to said at least one of said central members.

89. An interface apparatus as recited in claim 88 wherein said central members are coupled to an object member which is coupled to said user manipulatable object.

90. An interface apparatus as recited in claim 88 wherein said first and second central members are flexible and wherein said first and second central members and said first and second extension members are flexibly coupled to each other and form said unitary member.

91. An interface apparatus as recited in claim 88 wherein said ground member is rotatably coupled to said first and second extension members by bearings, said bearings allowing said first and second extension members to be rotated about said axes of rotation.

92. An interface apparatus as recited in claim 86 wherein at least one of said members flexibly coupled in said unitary member is relatively narrow in a dimension in which said member is desired to flex, and is relatively wide in other dimensions in which said member is desired to be stiff.

93. An interface apparatus as recited in claim 83 wherein said actuator is a first actuator coupled to a ground member, and further comprising a second actuator coupled to a ground member of said linkage, said second actuator being operative to apply a force in a degree of freedom to said user manipulatable object in response to signals received from said computer system.

94. An interface apparatus as recited in claim 88 wherein said central members are flexibly coupled to an object member which is coupled to said user manipulatable object.

95. An interface apparatus as recited in claim 88 wherein said end of said first central member is flexibly coupled to said first extension member, and said end of said second central member is flexibly coupled to said second extension member.

96. An interface apparatus as recited in claim 88 wherein said two axes of rotation are fixed with respect to said ground member, said first and second extension members being rotatable about said fixed axes of rotation, and wherein said central members are rotatable about

first and second floating axes, said floating axes being movable with respect to said ground member.

97. (amended) An interface apparatus as recited in claim [82] 86 wherein said user manipulatable object is a joystick handle.

98. An interface apparatus as recited in claim 83 wherein said actuator includes a voice coil actuator for imparting a force on said user object using magnetic fields and controlled by an electrical current.

99. A flexure linkage for providing motion to a user manipulatable object of an interface device, said interface device in communication with a computer system, said flexure linkage comprising:

a first member coupled to said user manipulatable object;

a second member coupled to said first member, wherein flex is provided between said second member and said first member; and

a third member coupled to said first member, wherein flex is provided between said third member and said first member, and wherein said first, second and third members form a unitary member;

wherein said flexure linkage provides at least two rotary degrees of freedom to said user manipulatable object about axes of rotation with respect to a ground such that said user manipulatable object can be moved by a user in said at least two rotary degrees of freedom and a position of said user manipulatable object in said two rotary degrees of freedom can be provided to said computer system.

Please cancel claims 102 and 103 without prejudice.

104. A flexure linkage as recited in claim 99 wherein said first and second members are coupled to an object member which is coupled to said user manipulatable object.

105. A flexure linkage as recited in claim 99 wherein at least one of said members flexibly coupled in said unitary member is relatively narrow in a dimension in which said member is desired to flex, and is relatively wide in other dimensions in which said member is desired to be stiff.

Please cancel claim 106 without prejudice.

107. (amended) A method as recited in claim [106] 110 further comprising applying a force along at least one of said at least two degrees of freedom to said user manipulatable object through said unitary member.

110. (amended) A method [as recited in claim 106] for interfacing motion of a user manipulatable object with a computer system, the method comprising:

providing said user manipulatable object physically contacted by a user and moveable by said user;

providing a linkage including a plurality of members wherein said plurality of members of said linkage are formed as a closed-loop linkage, wherein said plurality of members of said linkage are formed as a closed-loop linkage;

providing flex between a selected number of said members to provide at least two rotary degrees of freedom to said user manipulatable object about axes of rotation, wherein said selected number of members are formed as a unitary member; and

sensing a position or motion of said user manipulatable object in said at least two rotary degrees of freedom and outputting sensor signals, wherein said sensor signals, or a representation thereof, are received by said computer system.

111. (amended) A method as recited in claim [106] 110 wherein said [two] axes of rotation are fixed with respect to [said] a ground member of said plurality of members, wherein said plurality of members includes first and second extension members and a first central member coupled to said first extension member and a second central member coupled to said second extension member, wherein said first and second extension members being rotatable about said fixed axes of rotation, and wherein said central members are rotatable about first and second floating axes, said floating axes being movable with respect to said ground member.

Please cancel claim 112 without prejudice.